

The Moon can be considered a giant tape recorder containing the history of the solar system and Universe. The lunar regolith (soil) has recorded the early history of the Moon, Earth, the solar system and Universe. A major goal of future lunar exploration should be to find and play back existing fragments of that “tape”. By reading the lunar tape, we can uncover a record of planetary bombardment, as well as solar and stellar variability. The Moon can tell us much about our place in the Universe. The lunar regolith has likely recorded the original meteoritic bombardment of Earth and Moon, a violent cataclysm that may have peaked around 4 Gyr, and the less intense bombardment occurring since that time. This impact history is preserved on the Moon as regolith layers, ejecta layers, impact melt rocks, and ancient impact breccias. The impact history of the Earth and Moon possibly had profound effects on the origin and development of life. Decrease in meteor bombardment allowed life to develop on Earth. Life may have developed first on another body, such as Mars, then arrived via meteorite on Earth. The solar system may have experienced bursts of severe radiation from the Sun, other stars, or from unknown sources. The lunar regolith has recorded this radiation history in the form of implanted solar wind, solar flare materials and radiation damage. Lunar soil can be found sandwiched between layers of basalt or pyroclastic deposits. This filling constitutes a buried time capsule that is likely to contain well-preserved ancient regolith. Study of such samples will show us how the solar system has evolved and changed over time. The lunar “tape recorder” can provide detailed information on specific portions of solar and stellar variability. Data from the Moon also offers clues as to whether so-called fundamental constants have changed over time.